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To Mr. A.E. Martin
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A4A13

POSSIBLE EMI FROM 500-kV BY-PASS

D.E. Jones

Results of measurements on the experimental 500-kV by-pass erected at Darlington are presented. These include possible influence on reception of AM radio broadcast, TV and land mobile radio as well as audible noise.

At the request of the Transmission Lines Department a survey of possible electromagnetic interference (EMI) and audible noise from the experimental wood-pole 500-kV by-pass erected at Darlington has been carried out. This report discusses the measurements and predicts the possible impact that an installation of this kind might have on nearby residences.

Weather is a critical factor in both electromagnetic and audible noise. There was blowing snow for a few minutes just after the by-pass was energized. During our measurements, however, it was clear and cold with light wind. It will, therefore, be necessary to predict the possible influence of foul weather from the results of other investigations.

Influence on AM Radio Reception

Frequency spectra and lateral profiles of radio noise in the AM broadcast band were carried out. The results are shown on Figures 1 and 2. The noise at 1 MHz, 15 metres from the line, is between 54 and 62 dB above 1 μv/m. The CSA limit for noise from a 500-kV line in fair weather is 57 dB above 1 μv/m /1/. The noise may increase by up to 26 dB during heavy rain or snow. There is, however, no CSA limit for foul weather noise and it is accepted that interference may occasionally occur in low signal strength areas during foul weather. It is interesting to note that the slope of the frequency spectrum, falling off at about 3.5 dB per octave, approximates that of a "distribution line" as specified in the

CSA standard. This suggests that the fair weather noise is predominantly from the insulators rather than from conductor corona.

The by-pass is somewhat noisier than our normal 500-kV lines. It may result in some interference during fair weather to reception of low level radio signals at residences within about 150 metres of the line.*

Influence on TV Reception

Figures 3 and 4 show frequency spectra in the VHF band. They are seen to be relatively flat. This suggests that gap-type noise from hardware on the wood poles and insulator noise rather than conductor corona noise predominate during fair weather. It is difficult to predict the foul weather noise. Gap-type noise should disappear, insulator noise will probably decrease and corona noise will increase.

The fair weather noise level of 60 to 70 dB above 1 μv/m/MHz is slightly higher than typical levels on our normal 500-kV lines but is somewhat lower than typical levels on "noisy" distribution lines. It is suggested that interference to reception of low level TV signals may occasionally occur in fair or foul weather at residences very close to the by-pass.

Influence on land mobile communication systems

An accepted method of evaluating the possible interference to land mobile radio reception from "impulsive" noise is the Average Crossing Rate (ACR). This is measured by a special instrument that counts the number of times per second that noise impulses exceed specified levels. The heavy curve on Figure 5 is an ACR record of the 500-kV by-pass in fair weather. It shows for example, about 6×10^3 pulses above 40 dB above 1 μv/m, but only 1 pulse above 60 dB. The three lighter curves on Figure 5 are iso-degradation curves for a typical mobile radio receiver operating in the vicinity of 150 MHz. These represent ACR values that will degrade reception by 3, 5 or 7 dB. The 5 dB curve follows the ACR curve most closely. Thus, it is suggested that the by-pass may degrade mobile radio reception within 25 metres of the line by about 5 dB. This should not be a serious problem. The degradation will decrease at greater distances. Figure 4 for example, shows a considerable decrease in noise level at 50 metres from the line.

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* See Clause 4.2 of the CSA standard; based on a noise level of 65 dB above 1 μv/m and a signal level of 54 dB above 1 μv/m at the lower end of the AM broadcast band.

Influence of Audible Noise

It was planned to measure the audible noise level due to the by-pass. In fair weather, however, the audible noise from the line was masked by background noise from Highway 401 and Darlington construction. In any case it was too low to present any interference problem, even very close to the line.

The first few minutes that the line was energized, there was blowing snow. The audible noise, measured by the human ear rather than by a noise meter, was very high close to the line. It is suggested that this degree of noise could be objectionable at residences very close to the by-pass during periods of heavy rain or snow. Unfortunately no more specific conclusion can be drawn.

Approved:

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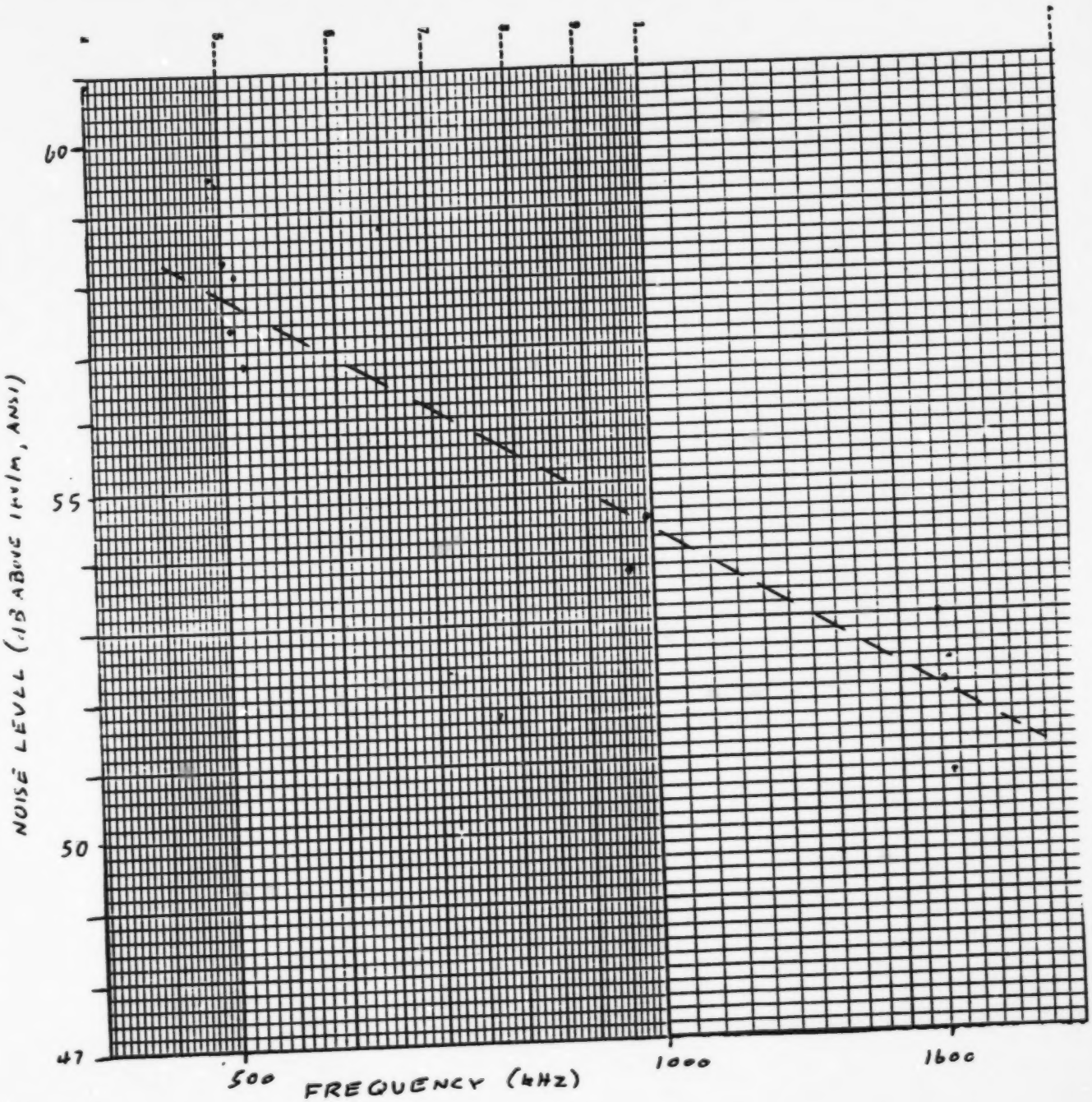
Reference

1. CSA Standard C108.3.1 - 1975, Tolerable Limits and Methods of Measurement of Electromagnetic Interference from Alternating Current High Voltage Power Systems 0.15 MHz - 30 MHz.



NOISE LEVEL 15 METRES LATERALLY FROM 500-KV BY-PASS, DARLINGTOIN

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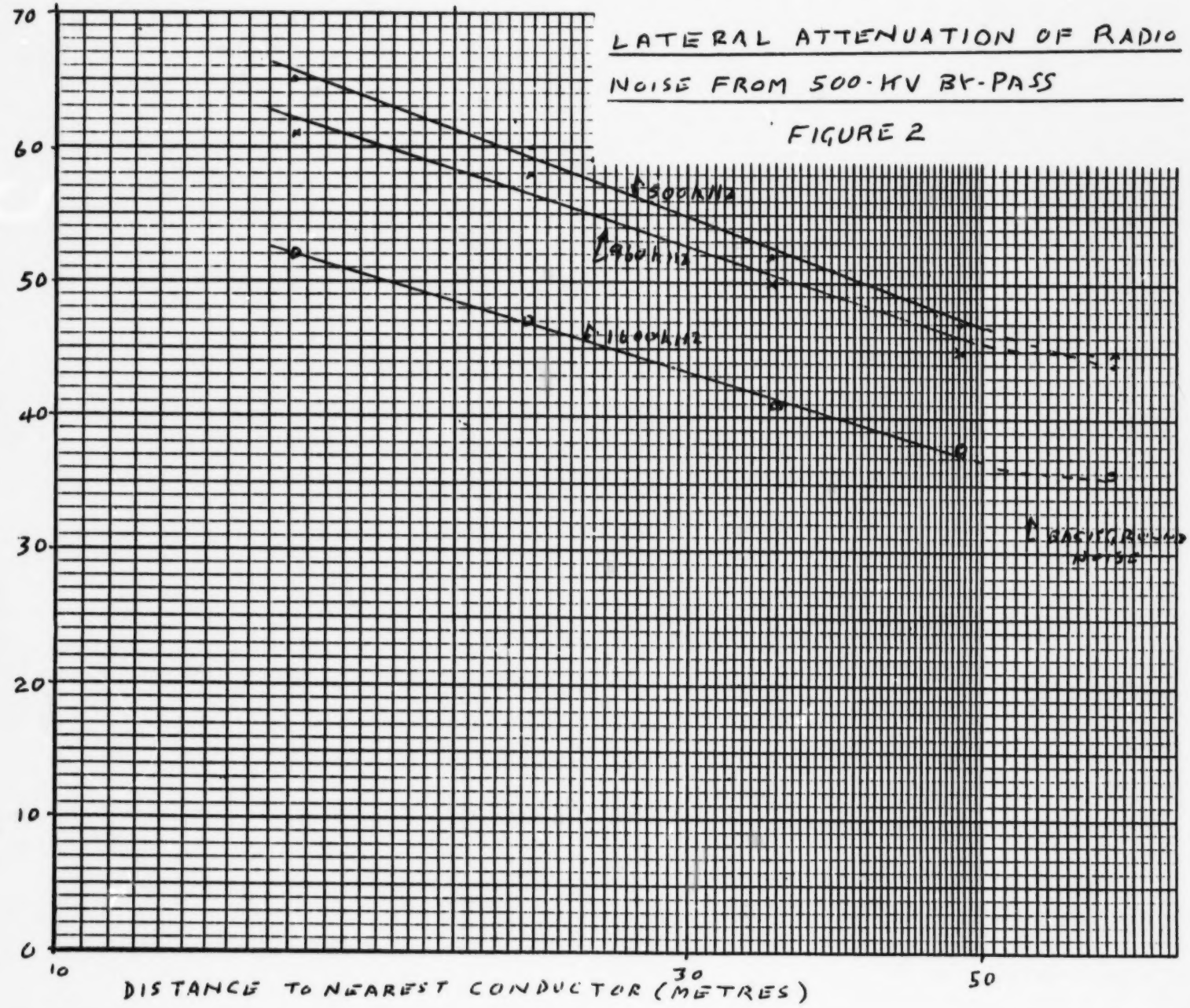
FIGURE 1

LATERAL ATTENUATION OF RADIO NOISE FROM 500-KV BY-PASS

FIGURE 2



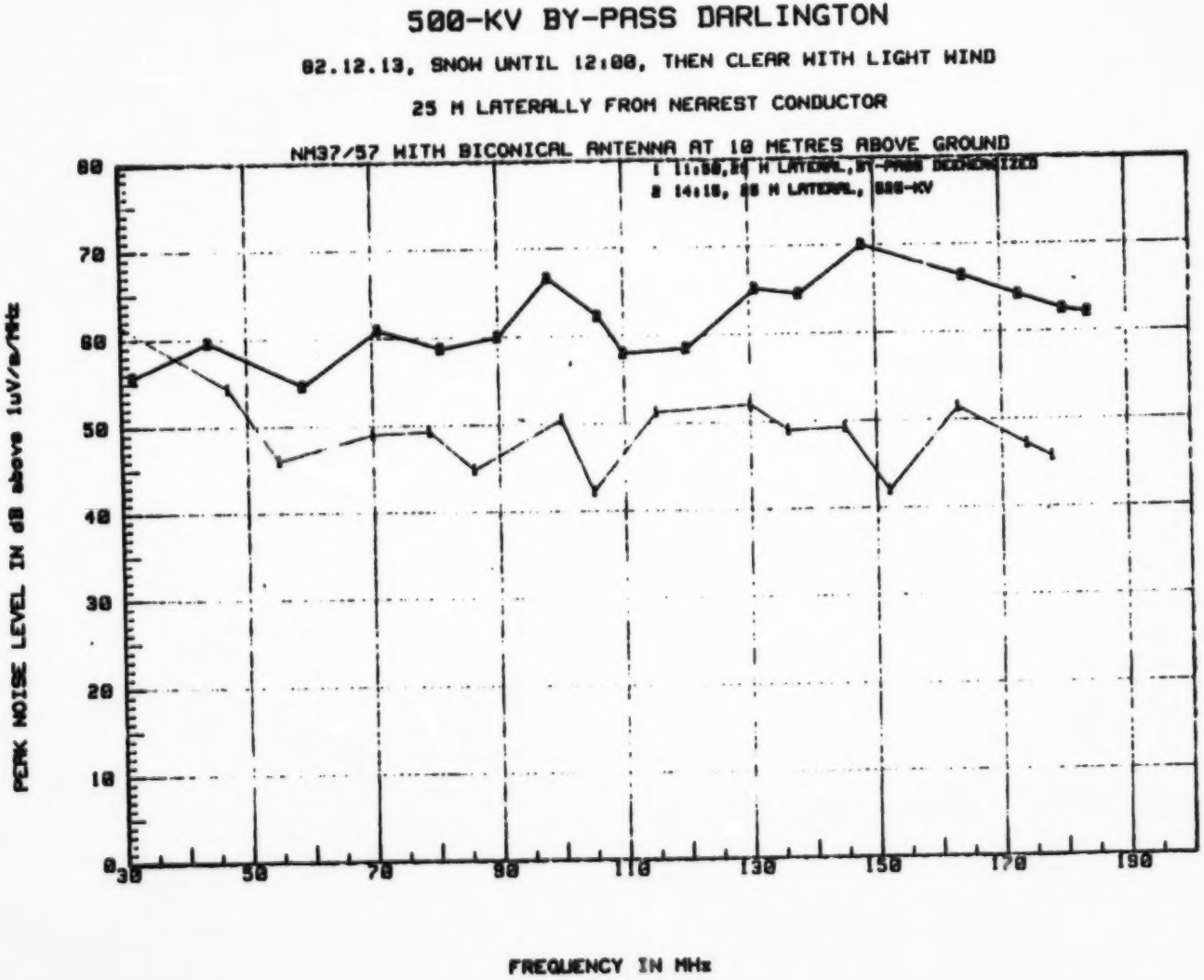

500-KV BY-PASS DARLINGTON
82.12.13, SNOW UNTIL 12:00, THEN CLEAR WITH LIGHT WIND
25 M LATERALLY FROM NEAREST CONDUCTOR
NM37/57 WITH BICONICAL ANTENNA AT 10 METRES ABOVE GROUND
PEAK NOISE LEVEL IN dB above 1uV/m/1kHz
FREQUENCY IN MHz
0
10
20
30
40
50
60
70
80
30
50
70
90
110
130
150
170
190

FIGURE 3

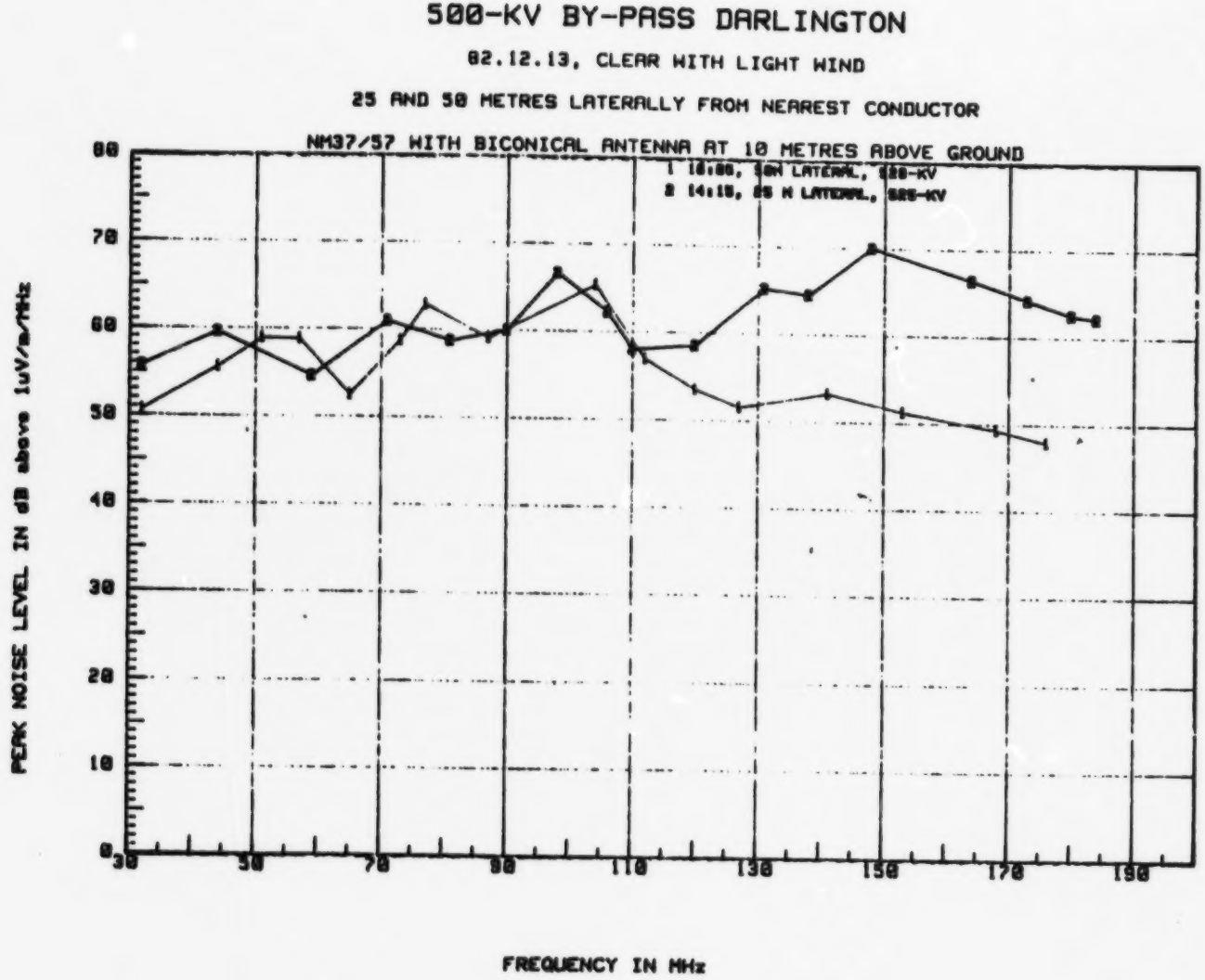

500-KV BY-PASS DARLINGTON
82.12.13, CLEAR WITH LIGHT WIND
25 AND 50 METRES LATERALLY FROM NEAREST CONDUCTOR
NM37/57 WITH BICONICAL ANTENNA AT 10 METRES ABOVE GROUND
1 18:00, 50M LATERAL, 500-KV
2 14:15, 25 M LATERAL, 500-KV
PEAK NOISE LEVEL IN dB above 1uV/m/MHz
80
70
60
50
40
30
20
10
0
30
50
70
90
110
130
150
170
190
FREQUENCY IN MHz

FIGURE 4

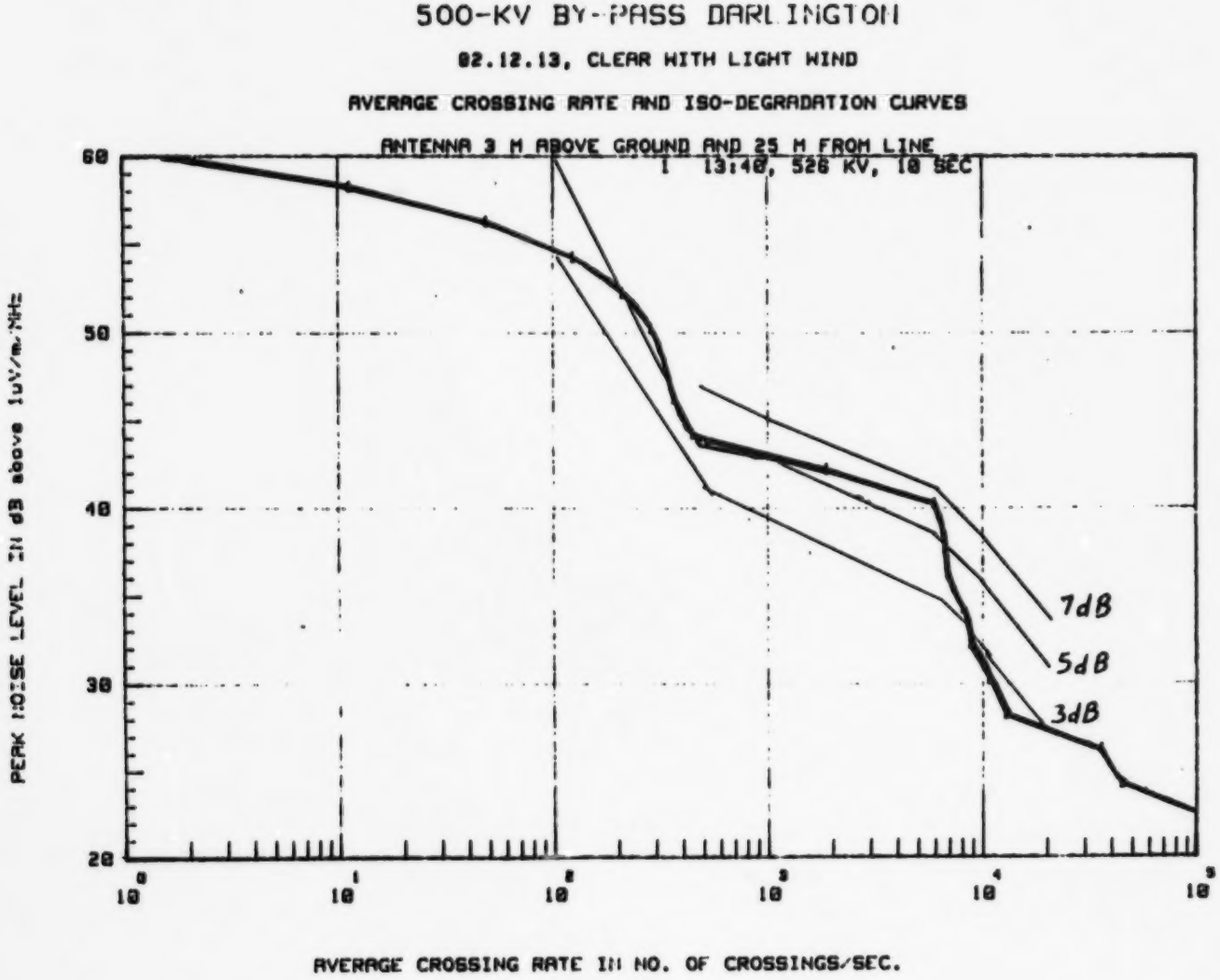

500-KV BY-PASS DARLINGTON
82.12.13, CLEAR WITH LIGHT WIND
AVERAGE CROSSING RATE AND ISO-DEGRADATION CURVES
ANTENNA 3 M ABOVE GROUND AND 25 M FROM LINE
1 13:40, 526 KV, 10 SEC
PEAK NOISE LEVEL IN dB above 1uV/m/MHz
60
50
40
30
20
7dB
5dB
3dB
10^0
10^1
10^2
10^3
10^4
10^5
AVERAGE CROSSING RATE IN NO. OF CROSSINGS/SEC.

FIGURE 5

POOR

QUALITY

ORIGINAL